

# Claims

- [c1] 1. An additive composition for use as at least a partial replacement for mixed metal, alkali-metal and tin-based stabilizer additives for use in vinyl resins wherein said composition comprises:
- (a) at least two phosphite esters selected from the group consisting of
    - (i) triaryl phosphites and  $C_{1-9}$  alkyl substituted derivatives thereof,
    - (ii)  $C_{8-15}$  alkyl phosphites,
    - (iii) mixed phosphites having at least one  $C_{8-15}$  alkyl moiety and at least one aryl moiety therein, a combination of said moieties totaling three,
    - (iv)  $C_{10-15}$  alkyl bisphenol-A phosphites and  $C_{1-9}$  alkyl substituted derivatives thereof,
    - (v) poly- and mono- alkylene glycol phosphites,
    - (vi)  $C_{8-15}$  pentaerythritol phosphites, and
    - (vii) mono- and di-  $C_{8-15}$  alkyl p-cumyl phenol phosphites and  $C_{1-9}$  alkyl substituted derivatives thereof; and
  - (b) a zinc additive wherein a molar ratio of P/Zn is

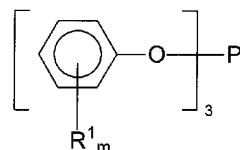
from about 80:1 to 4:1, and wherein said composition is essentially free of calcium, cadmium, barium and tin.

[c2] 2. The composition of claim 1 wherein  
(a) said ratio is from about 75:1 to 6:1.

[c3] 3. The composition of claim 2 wherein  
(a) said ratio is from about 73:1 to 8:1.

[c4] 4. The composition of claim 1 wherein said at least two phosphite esters are selected from the group consisting of

(a) triaryl phosphites and C<sub>1-9</sub> alkyl substituted derivatives thereof of formula (I)



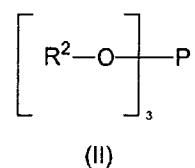
(I)

wherein

R<sup>1</sup> is independently selected from the group consisting of  
H and C<sub>1-9</sub> alkyl, and

m is an integral value from 0 to 1 inclusive,

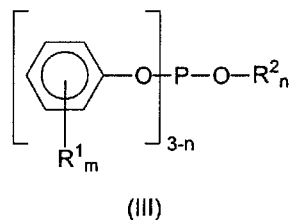
- (b) C<sub>8-15</sub> trialkyl phosphites of formula (II)



wherein

R<sup>2</sup> is selected from the group consisting of C<sub>8-15</sub> alkyl,

- (c) mixed phosphites having at least one C<sub>8-15</sub> alkyl moiety and at least one aryl moiety of formula (III)



wherein

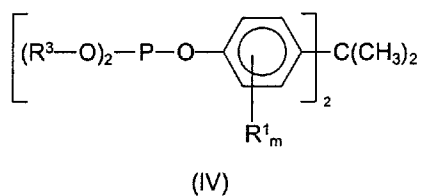
R<sup>1</sup> is as previously defined,

R<sup>2</sup> is as previously defined,

m is as previously defined, and

n is an integral value from 1 to 2,

- (d) C<sub>10-15</sub> alkyl bisphenol-A phosphites of formula (IV) and C<sub>1-9</sub> alkyl substituted derivatives thereof

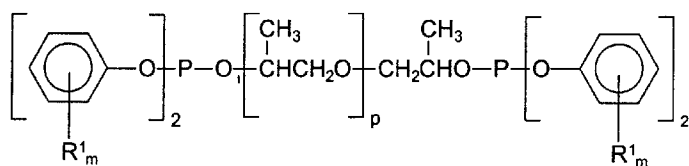


wherein

R<sup>1</sup> is as previously defined,

$R^3$  is  $C_{10-15}$  alkyl, and  
 $m$  is as previously defined,

(e) poly- and mono- alkylene glycol phosphites of formula (V)

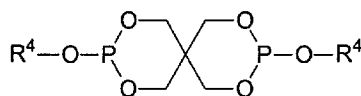


(V)

wherein

$R^1$  is as previously defined,  
 $m$  is as previously defined, and  
 $p$  is an integral value from 0 to 1 inclusive,

(f)  $C_{8-15}$  pentaerythritol phosphites of formula (VI) and  $C_{1-9}$  alkyl substituted derivatives thereof

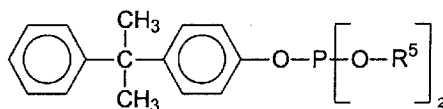


(VI)

wherein

$R^4$  is the same as  $R^1$ , and

(g) mono- and di-  $C_{8-15}$  alkyl *p*-cumyl phenol phosphites and  $C_{1-4}$  alkyl substituted derivatives thereof of formula (VII)



(VII)

wherein

$R^5$  is the same as  $R^1$ .

[c5] 5. The composition of claim 4 wherein a percentage weight loss of said composition as measured as a difference between a start and an end weight of said composition as measured after exposure to two hours at 110°C, is less than 1% by weight.

[c6] 6. The composition of claim 5 wherein a percentage weight loss is less than 0.5% by weight.

[c7] 7. The composition of claim 4 wherein

Fourth Inventor

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ASSIGNMENT OF INVENTION

In consideration of the payment by ASSIGNEE to ASSIGNOR of the sum of One Dollar (\$1.00), the receipt of which is hereby acknowledged, and for other good and valuable consideration,

ASSIGNOR:

Inventor(s) or person(s) or  
Entity(ies) who own the  
invention

Michael R. Jakupca  
(type or print name(s) of ASSIGNOR(s))  
810 37th St. N.W.  
Address  
Canton, Ohio 44709  
US  
Nationality

(If assignment is by person or entity to whom invention was previously assigned  
and this was recorded in PTO, add the following)

Recorded on \_\_\_\_\_ Reel \_\_\_\_\_  
Frame \_\_\_\_\_

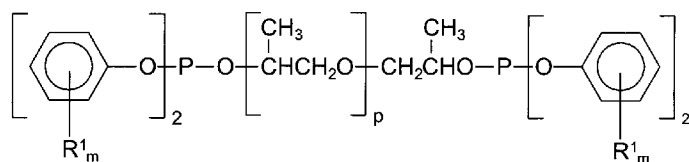
hereby sells, assigns and transfers to

ASSIGNEE:

Dover Chemical Corporation  
(type or print name(s) of ASSIGNEE(s))  
3676 Davis Rd., NW  
Address  
Dover, Ohio 44622  
US  
Nationality

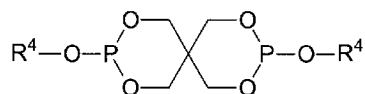
and the successors, assigns and legal representative of the ASSIGNEE

(iii) poly- and mono- alkylene glycol phosphites of formula (V)



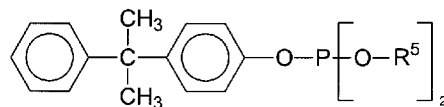
(V),

(iv) C<sub>8-15</sub> pentaerythritol phosphites of formula (VI)



(VI),

(v) mono- and di- C<sub>8-15</sub> alkyl *p*-cumyl phenol phosphites and C<sub>1-4</sub> alkyl substituted derivatives thereof of formula (VII)



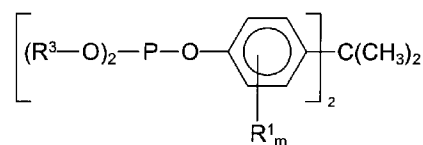
(VII),

wherein

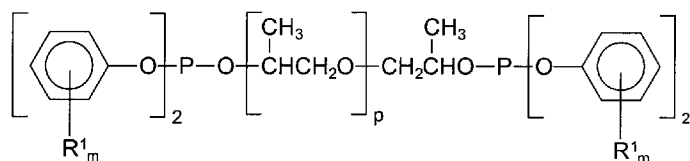
R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, m, n and p are as previously defined.

[c8] 8. The composition of claim 7 wherein said at least one second phosphite ester is selected from the group consisting of

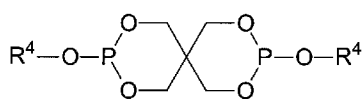
C<sub>10-15</sub> alkyl bisphenol-A phosphites of formula (IV)



poly- and di- alkylene glycol phosphites of formula (V)



C<sub>8-15</sub> pentaerythritol phosphites of formula (VI)

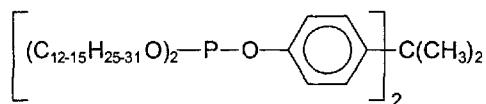


wherein

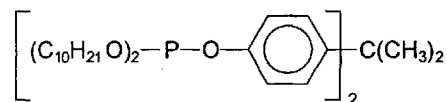
R<sup>1</sup>, R<sup>3</sup>, R<sup>4</sup>, m and p are as previously defined.

[c9] **9. The composition of claim 1 wherein said phosphite ester is selected from the group consisting of**

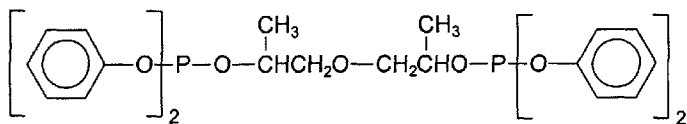
C<sub>12-15</sub> bisphenol-A phosphite of formula (VIII)



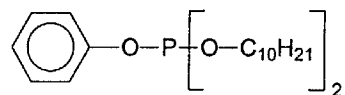
C<sub>10</sub> bisphenol-A phosphite of formula (IX)



tetraphenyl dipropylene glycol diphosphite of formula (X)

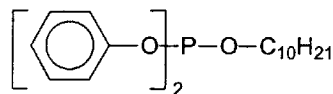


phenyl diisodecyl phosphite of formula (XI)



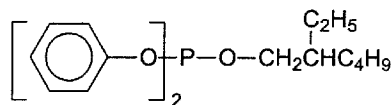
(XI),

diphenyl isodecyl phosphite of formula (XII)



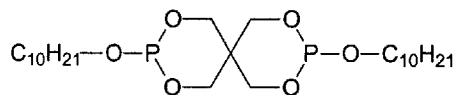
(XII),

diphenyl 2-ethylhexyl phosphite of formula (XIII)



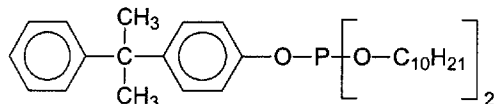
(XIII),

diisodecyl PE diphosphite of formula (XIV), and



(XIV),

mono *p*-cumyl phenol diisodecyl phosphite of formula (XV)



(XV).

[c10] 10. The composition of claim 1 which further comprises a halogenated resin.

[c11] 11. The composition of claim 10 wherein a level of zinc is approximately 50 to 800 ppm zinc per 100 parts resin.

[c12] 12. The composition of claim 11 wherein said level of zinc is approximately 100 to 500 ppm zinc per 100 parts resin.

[c13] 13. The composition of claim 12 wherein said level of

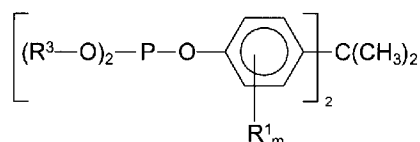


zinc is approximately 100 to 250 ppm zinc per 100 parts resin.

[c14] 14. The composition of claim 11 wherein said halo-genated resin is flexible polyvinyl chloride.

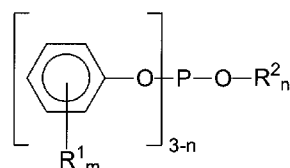
[c15] 15. An additive composition for use as at least a partial replacement for mixed metal and tin-based stabilizer additives for use in resins wherein said composition comprises at least two phosphite esters, and wherein:

- (a) a first phosphite ester is C<sub>10-15</sub> alkyl bisphenol-A phosphites of formula (IV) and C<sub>1-9</sub> alkyl substituted derivatives thereof



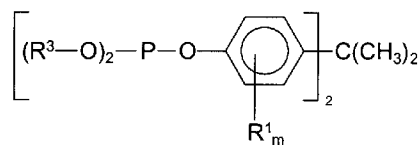
(IV), and

- (b) at least one second phosphite ester is selected from the group consisting of  
(i) mixed phosphites having at least one C<sub>8-15</sub> alkyl moiety and at least one aryl moiety of formula (III)



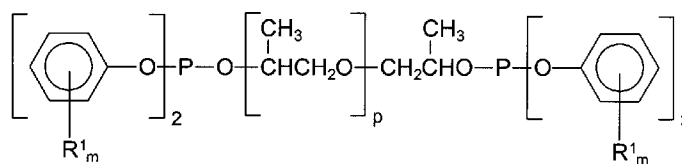
(III),

- (ii) C<sub>10-15</sub> alkyl bisphenol-A phosphites of formula (IV)



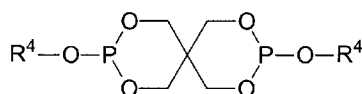
(IV),

- (iii) poly- and mono- alkylene glycol phosphites of formula (V)



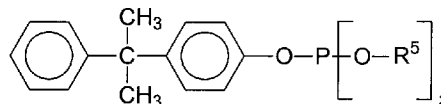
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(iv) C<sub>8-15</sub> pentaerythritol phosphites of formula (VI)



(VI),

(v) mono- and di- C<sub>8-15</sub> alkyl *p*-cumyl phenol phosphites and C<sub>1-4</sub> alkyl substituted derivatives thereof of formula (VII)



(VII),

wherein

R<sup>1</sup> is independently selected from the group consisting of H and C<sub>1-9</sub> alkyl,

R<sup>2</sup> is selected from the group consisting of C<sub>8-15</sub> alkyl,

R<sup>3</sup> is C<sub>10-15</sub> alkyl,

R<sup>4</sup> is the same as R<sup>1</sup>,

R<sup>5</sup> is the same as R<sup>1</sup>,

m is an integral value from 0 to 1 inclusive,

n is an integral value from 1 to 2, and

p is an integral value from 0 to 1 inclusive.

(c) a zinc additive wherein a molar ratio of P/Zn is from about 80:1 to 4:1; and

(d) said composition is essentially free of calcium, cadmium, barium and tin.

[c16] 16. The composition of claim 15 which further comprises polyvinyl chloride.

[c17] 17. The composition of claim 16 wherein a level of zinc is approximately 50 to 800 ppm zinc per 100 parts polyvinyl chloride.

[c18] 18. The composition of claim 17 wherein said level of zinc is approximately 100 to 500 ppm zinc per 100 parts polyvinyl chloride.

[c19] 19. The composition of claim 18 wherein said level of

zinc is approximately 100 to 250 ppm zinc per 100 parts polyvinyl chloride.

[c20] 20. The composition of claim 15 wherein said polyvinyl chloride is flexible polyvinyl chloride.